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Single CO peak in the double bar galaxy NGC 5850

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1. Introduction

NGC 5850 is the prototype of double barred galaxy (Friedli et al., 1996) classified as SBb(sr) I-II (Higdon et al. 1998, Prieto et al. 1997). This kind of system is primordial to understand the physical mechanism responsible for feeding galaxy nuclei and boost the star formation rate. Schlosman et al. (1989) proposed that the nuclear bar would produce the inwards inflow of the molecular gas trapped on the primary ILR through the nuclear bar resonances. Higdon et al. (1998) emphasized that NGC 5850 has likely been perturbed by a high-speed encounter with the nearby massive elliptical NGC 5846.

2. Molecular gas and other tracers

We have observed the CO(1-0) emission of the galaxy NGC 5850: mapped the very center, using the IRAM Plateau de Bure interferometer, to reach a 2.4"×1.5" (PA=-165°) spatial resolution (Fig. **??**), and mapped the primary bar with the IRAM-30m telescope, with a 22″ beam. We estimate the flux missed by the interferometer to about 40 % of the single-dish flux. The total flux in the center is 41.7 Jy/beam for the interferometer. To estimate the H_2 surface density in the center, we used the standard conversion factor $N(H_2)/I_{CO}$=2.3 10^{20} cm^{-2}K^{-1}km^{-1}s. The northern concentration of gas, reaches a surface density of 200 $M_\odot pc^{-2}$ (not including 30% He). The total H_2 towards the center is about 6.7 10^7 $M_\odot$ with the interferometer. Using the single-dish, we find that the primary bar has about 3.4 10^9 $M_\odot$ of molecular gas.

The critical surface density Σ_c for gravitational instabilities (e.g. Kennicutt 1989) is: $\Sigma_c = \alpha \frac{\kappa\sigma}{3.36G}$, with κ the epicyclic frequency, σ the velocity dispersion of the gas and α is a constant close to unity. The northern concentration, likely made of a collection of Giant Molecular Clouds (GMC), has a *global* velocity dispersion of $\sim$ 75 km/s. The critical surface density is then 1350 $M_\odot pc^{-2}$ which is much higher than the peak value observed. It may explain why no star formation has occured in that great reservoir of molecular gas as traced by the

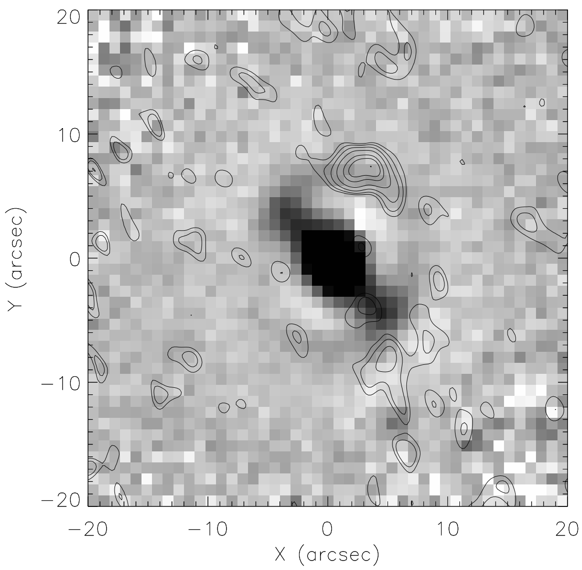

Figure 1. Small scale details (spatial filtering scale $< 1.6''$) on the J image overlaid by CO($1\rightarrow0$) integrated intensity contours (0.01, 0.012, 0.016, 0.02, 0.025, 0.03, 0.04, 0.05, 0.063, 0.08, 0.1 Jy/beam).

H_α emission. The HI gas (3.3 10^9 $M_\odot$) is more concentrated in the larger inner ring and outer arms of the galaxy (Higdon et al. 1998).

3. Conclusion

We have found CO emission in the center of NGC 5850, located in a single peak on the northern part of the nuclear ring. The high velocity dispersion of the molecular gas may prevent star formation in that region. The CO distribution in the center of barred galaxies is generally found to be either in the nucleus (García-Burillo et al. 1998) or trapped in twin peaks related to the resonances of the bars (Kenney et al. 1992, Downes et al. 1996, García-Burillo et al. 1998). Gas simulations performed with a single bar pattern and without the tidal influence of the companion NGC 5846 are unable to reproduce the features observed in NGC 5850 (Combes, Leon & Buta 1998). The decoupling of a second bar appears necessary. The presence of the single molecular peak could be due to an $m = 1$ mode excited by the massive companion.

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